

# 2015 Monitoring Summary



## Lindsey Creek at Barbour County Road 41 (31.72006/-85.48532)

### BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected Lindsey Creek watershed for water quality monitoring as part of the 2015 statewide monitoring plan. The objectives of this project were to assess the biological integrity of each monitoring site and to estimate overall water quality within the basin.



Figure 1. Lindsey Creek at LNDB-1, March 18, 2015.

### WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Lindsey Creek is a *Fish and Wildlife (F&W)* stream located in the Southern Hilly Gulf Coastal Plain ecoregion (65d). Based on the 2011 National Land Cover Dataset, landuse within the watershed is primarily forest (52%). As of April 1, 2016 one outfall was active within the watershed.

### REACH CHARACTERISTICS

General observations (Table 2) and a habitat assessment (Table 3) were completed during the macroinvertebrate assessment. In comparison with reference reaches in the same ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Lindsey Creek at LNDB-1 is a glide-pool stream with a bottom substrate dominated by sand (Figure 1). Habitat quality and availability were rated *Sub-optimal* for supporting diverse aquatic macroinvertebrate communities.

### BIOASSESSMENT RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). The WMB-I uses measures of taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community in comparison to conditions expected in Alabama Coastal Plain streams and rivers. Each site is placed in one of six levels, ranging from 1, or *natural* to 6, or *highly altered*. The macroinvertebrate survey conducted at LNDB-1 rated the site as a 4-, or *fair-poor* (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
<b>Basin</b>	Choctawhatchee River	
<b>Drainage Area (mi<sup>2</sup>)</b>	40	
<b>Ecoregion<sup>a</sup></b>	65D	
<b>% Landuse<sup>b</sup></b>		
Open water		<1%
Wetland	Woody	3%
	Emergent herbaceous	<1%
Forest	Deciduous	19%
	Evergreen	26%
	Mixed	7%
Shrub/scrub		20%
Grassland/herbaceous		2%
Pasture/hay		10%
Cultivated crops		8%
Development	Open space	4%
	Low intensity	1%
	Moderate intensity	<1%
	High intensity	<1%
Barren		<1%
<b>Population/km<sup>2c</sup></b>	11	
<b># NPDES Permits<sup>d</sup></b>	<b>TOTAL</b>	1
	Construction	1

a. Southern Hilly Gulf Coastal Plain

b. 2011 National Land Cover Dataset

c. 2010 US Census

d. #NPDES outfalls downloaded from ADEM's NPDES Management System database, April 1, 2016.

Table 2. Physical characteristics of Lindsey Creek at LNDB-1, May 5, 2015.

Physical Characteristics		
<b>Width (ft)</b>	29	
<b>Canopy Cover</b>	Mostly Shaded	
<b>Depth (ft)</b>		
	Run	1.0
	Pool	3.5
<b>% of Reach</b>		
	Run	40
	Pool	60
<b>% Substrate</b>		
	Clay	5
	Mud/Muck	5
	Hard Pan Clay	5
	Sand	75
	Silt	5
	Organic Matter	5

**Table 3.** Results of the habitat assessment conducted on Lindsey Creek at LNDB-1, May 5, 2015.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	47	Marginal (31-<55)
Sediment Deposition	43	Marginal (31-<55)
Sinuosity	60	Sub-Optimal (55-79)
Bank Vegetative Stability	55	Marginal (31-<58)
Riparian Buffer	75	Sub-Optimal (60-84)
<b>Habitat Assessment Score</b>	<b>101</b>	
<b>% Maximum Score</b>	<b>59</b>	<b>Sub-Optimal (57-80)</b>

**Table 4.** Results of the macroinvertebrate bioassessment conducted in Lindsey Creek at LNDB-1, May 5, 2015.

Macroinvertebrate Assessment		Results
<b>Taxa richness and diversity measures</b>		
	Total # Taxa	37
	# EPT taxa	8
	# Highly-sensitive and Specialized Taxa	1
<b>Taxonomic composition measures</b>		
	% EPC taxa	29
	% EPT minus Baetidae and Hydropsychidae	10
	% Chironomidae Individuals	76
	% Dominant Taxon	27
	% Individuals in Dominant 5 Taxa	68
<b>Functional feeding group</b>		
	# Collector Taxa	8
	% Tolerant Filterer Taxa	16
<b>Community tolerance</b>		
	# Sensitive EPT	2
	% Sensitive taxa	16
	% Nutrient Tolerant individuals	21
	<b>WMB-I Assessment Score</b>	<b>4-</b>
	<b>WMB-I Assessment Rating</b>	<b>Fair-Poor</b>

## WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements and water samples were collected March through October of 2015 to help determine the water quality. Organics were collected at Lindsey Creek on April 28th; however, all parameters were below detection limits. Median values for specific conductance and hardness were higher than background levels for ecoregion 65d. Median dissolved iron concentrations were greater than 90% of all verified ecoregional reference reach data collected in the Southern Hilly Gulf Coastal Plain ecoregion. *E.coli* exceeded *Fish and Wildlife (F&W)* use classification for the sample collected in September.

## SUMMARY

The water quality samples collected in 2015 at LNDB-1 show that Lindsey Creek is not meeting *F&W* use classification due to *E.coli* exceedances. Bioassessment results indicated the macroinvertebrate community to be in *fair-poor* condition. Monitoring should continue at LNDB-1 to ensure that water quality conditions remain stable, and to further investigate the cause of the higher than expected water quality results.

**Table 5.** Summary of water quality data collected March-October, 2015. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value. Median, average (Avg), and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

Parameter	N	Min	Max	Med	Avg	SD	Q	E
<b>Physical</b>								
Temperature (°C)	10	18.1	25.7	20.3	21.2	2.9		
Turbidity (NTU)	10	7.0	14.7	10.1	10.5	2.8		
Total Dissolved Solids (mg/L)	8	36.0	54.0	46.5	46.4	6.4		
<sup>J</sup> Total Suspended Solids (mg/L)	8	3.0	10.0	4.0	4.8	2.4		
Specific Conductance (µmhos/cm)	10	54.6	72.7	64.1 <sup>G</sup>	62.9	5.6		
Hardness (mg/L)	4	28.5	32.0	31.3 <sup>G</sup>	30.8	1.6		
<sup>J</sup> Alkalinity (mg/L)	8	22.4	128.0	26.0	38.2	36.3		
Monthly Stream Flow (cfs)	9	9.3	50.0	24.9	24.5	12.4		
Measured Stream Flow (cfs)	9	9.3	50.0	24.9	24.5	12.4		
<b>Chemical</b>								
Dissolved Oxygen (mg/L)	10	7.0	8.5	7.7	7.8	0.5		
pH (SU)	10	6.7	7.1	7.0	6.9	0.2		
<sup>J</sup> Ammonia Nitrogen (mg/L)	8	< 0.007	0.034	0.011	0.012	0.010		
<sup>J</sup> Nitrate+Nitrite Nitrogen (mg/L)	8	0.202	0.285	0.243	0.240	0.030		
Total Kjeldahl Nitrogen (mg/L)	8	< 0.064	0.433	0.334	0.300	0.140		
<sup>J</sup> Total Nitrogen (mg/L)	8	< 0.266	0.692	0.566	0.540	0.142		
<sup>J</sup> Dis Reactive Phosphorus (mg/L)	8	< 0.003	0.005	0.004	0.004	0.001		
Total Phosphorus (mg/L)	8	0.014	0.019	0.016	0.017	0.002		
CBOD-5 (mg/L)	8	< 2.0	< 2.0	1.0	1.0	0.0		
Chlorides (mg/L)	8	3.0	4.1	3.6	3.6	0.3		
Atrazine (µg/L)	1	<		<	0.10			
<b>Total Metals</b>								
<sup>J</sup> Aluminum (mg/L)	4	< 0.106	0.162	0.090	0.099	0.055		
<sup>J</sup> Iron (mg/L)	4	0.127	2.010	1.535	1.302	0.826		
<sup>J</sup> Manganese (mg/L)	4	0.119	0.179	0.153	0.151	0.028		
<b>Dissolved Metals</b>								
Aluminum (mg/L)	4	< 0.106	< 0.106	0.053	0.053	0.000		
Antimony (µg/L)	4	< 0.342	< 0.342	0.171	0.171	0.000		
<sup>J</sup> Arsenic (µg/L)	4	0.378	0.513 <sup>H</sup>	0.430	0.438	0.056		4
Cadmium (µg/L)	4	< 0.311	< 0.311	0.156	0.156	0.000		
<sup>J</sup> Chromium (µg/L)	4	< 0.347	0.405	0.174	0.231	0.116		
<sup>J</sup> Copper (µg/L)	4	< 0.218	0.258	0.226	0.205	0.066		
Iron (mg/L)	4	0.995	1.470	1.185 <sup>M</sup>	1.209	0.205		
Lead (µg/L)	4	< 0.428	< 0.428	0.214	0.214	0.000		
<sup>J</sup> Manganese (mg/L)	4	0.085	0.136	0.090	0.100	0.024		
Nickel (µg/L)	4	< 0.460	< 0.460	0.230	0.230	0.000		
Selenium (µg/L)	4	< 0.395	< 0.395	0.198	0.198	0.000		
Silver (µg/L)	4	< 0.365	< 0.365	0.182	0.182	0.000		
Thallium (µg/L)	4	< 0.514	< 0.514	0.257	0.257	0.000		
<sup>J</sup> Zinc (µg/L)	4	< 0.522	1.196	0.746	0.737	0.390		
<b>Biological</b>								
Chlorophyll a (mg/m³)	8	< 0.10	< 1.00	0.50	0.33	0.23		
<sup>J</sup> <i>E. coli</i> (MPN/DL)	8	41.4	579.4 <sup>H</sup>	134.8	202.9	182.8		1

E=# samples with exceedances; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 65d; H=*F&W* human health criteria exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 65d; N=# samples Q=# samples with uncertain exceedances.

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